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DESIGN AND MODELING OF THE MULTIBEAMLET INJECTOR*

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For both HIF and ion driven HEDP experiments, the beams a driver produces must have both high brightness and high current. The US HIF program has had extensive experience and success working with single, monolithic ion sources for accelerator experiments with moderate injector current requirements. Such sources produce up to hundreds of milliAmps with normalized emittances less than 1 π-mm-mrad. However, with a need for higher current sources, up to and over 1 A, monolithic sources begin to suffer from the poor scaling of source area to current. That is, by combining the limits of space-charge limited emission, voltage breakdown, and good optics, the source area is seen to scale as a high power of the current, A~I^8/3. A means of bypassing the scaling, leading to a much more compact injector, is use of multiple beamlets, each of which can have a much higher current density than a larger monolithic beam. The beamlets are merged near the end of the injector. A major challenge is the inherent emittance growth that occurs as the beamlets merge. In this paper, the design of such an injector will be presented along with simulations used to study and validate the design. This design offers other advantages, and some disadvantages, that will be described. Finally, comparisons will be made to experimental results from the merging beamlet experimental campaign on STS-100 and STS-500.

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